

**Wisconsin Highway Research Program
Request for Proposal for**

**Evaluating the Methodology and Performance of Jetting and Flooding Granular
Backfill Materials**

**Proposals must be submitted
no later than 11:59 PM CST
Thursday, April 15th, 2010**

**For further information regarding this RFP
contact Andrew Hanz
at (608) 262-3835
E-mail: ajhanz@wisc.edu**

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Researcher Proposal Preparation Guidelines

WHRP Proposal Guidelines are available on the WHRP website (<http://www.whrp.org/rfps-and-guidelines.html?current=three&sub=none>). Please refer to these instructions in preparation of your response.

I. PROBLEM TITLE

Evaluating the Methodology and Performance of Jetting and Flooding Granular Backfill Materials.

II. BACKGROUND AND PROBLEM STATEMENT

The Wisconsin Department of Transportation (WisDOT) typically compacts granular backfill or structure backfill materials by mechanical methods. Examples of this include abutment backfills and utility trenches. The mechanical methods typically require the contractor to place the granular material in minimum loose lifts of 12-inches or less and then use compaction equipment to reduce the air voids and increase the density of the material until the required compaction is achieved. The granular material is defined in WisDOT Standard Specifications Section 209 Granular Backfill and Section 210 Structure Backfill. Compaction operations are similarly discussed in Section 207. This compaction is difficult in confined areas and takes both time and resources to complete the work. Alternatively, as stated in the specifications, the engineer can allow jetted compaction or flooded compaction methods under the appropriate conditions. This has the potential to reduce the contractor's time and achieve an equivalent densely compacted granular material.

The two methods are described below:

Jetting is the process of inserting and removing a metal pipe that introduces water under pressure saturating the granular material from the bottom of the fill upward. After the water quickly drains out of the fill, the soils are compacted. The location and number of pipes can be adjusted based on the conditions encountered.

Flooding is the process of flooding an area with water and the saturating of the granular material from the top of the fill downward. The water quickly drains out of the fill, causing compaction to occur in the granular soils. The amount and rate of water can be adjusted based on the conditions encountered.

Both methods require the water to be confined within the granular materials being compacted, and allowed to quickly drain out of the system.

WisDOT is looking to have the researcher provide a literature search into the methodology concerning these compaction techniques. The researcher will also provide laboratory testing and field monitoring programs for the two typical applications, including bridge abutment backfills and utility trenches. The researcher will compare compaction using mechanical methods to water compaction methods.

III. SCOPE

This research project can be divided into four phases. The Department will review work after the first phase to determine if these technologies have promise and the remaining phases should be completed, or if benefits are limited and the study should be terminated.

The first phase will be to conduct a thorough literature search of any similar-type studies that may have been completed. This search will also include gathering other background data/studies that would have applicability to this research (including other state DOT's practices). Based on the review of current practice the researcher will make recommendations related to the feasibility of applying these technologies to WisDOT practice and if necessary develop a work plan for evaluating these compaction technologies in the laboratory and the field. The literature review, recommendations, and experimental plan will be submitted in the form of a report to the Technical Oversight Committee (TOC). A meeting will be scheduled with TOC to review these findings and discuss next steps.

The second phase of the work will be to implement the work plan developed for the laboratory work to further define the parameters (initial density, moisture content, grain size distribution, permeability, drain capacity, water quantity and final density and moisture content) and performance of the jetting and flooding methodology (reduction in void ratio). Findings will be shared with the Department and reviewed, prior to continuation of the work.

The third phase will involve implementing the work plan for performing a field study of the jetting compaction method and the flooding compaction method. The researcher will work with the Department and a contractor to locate suitable projects. The granular soil characteristics (Standard Proctor, grain size distribution, void ratio) will be determined by the research team. The degree of compaction should be established from nuclear density gauge (NDG) test results and dynamic cone penetrometer (DCP) test results, both before, and after, jetting and flooding activities. The details of the optimum methodologies should be investigated. The investigator will also develop a field measurement program and monitor the long term performance (settlement) of the granular fill for at least one complete freeze/thaw season.

The fourth phase of work will require the development of specifications for WisDOT for the use of compaction jetting and compaction flooding.

All data, findings, analyses and recommendations will be presented in a final report.

IV. SPECIFIC RESULTS, FINDINGS, TOOLS, ETC.

Results will provide needed data and analyses to help WisDOT evaluate the use of compaction jetting and compaction flooding. A final report documenting all research findings and conclusions will be required. Implementation of findings will be conducted by WisDOT, as appropriate.

V. LENGTH OF RESEARCH PROJECT AND APPROXIMATE COST

It is estimated that the time required for all four phases of the project should not exceed 36 months. The draft final report should be submitted in electronic format after month 33 to accommodate TOC review, scheduling of the final presentation and incorporation of review comments in the final report. The researcher will deliver 36 paper copies of the final report, along with an electronic version. The cost is estimated to be \$74,000.

Phase 1 of the research will be for 12 months, at a cost of \$34,000. The remaining phases of the project, if approved for funding, will be completed in 24 months at a cost of \$40,000. Award of Phase 1 of the project does not guarantee the award of Phases 2-4.

VI. URGENCY AND POTENTIAL BENEFITS

WisDOT transportation facilities often require the compaction of granular materials. Compaction by jetting or flooding, in some circumstances, may be more cost effective and result in time savings for the contractor. If specifications can be used to fully define these operations, contractors could provide a lower bid price for granular fill or structure backfill.

VII. ADDITIONAL REQUIREMENTS FOR IMPLEMENTATION

Results from this study will provide the Department with information to determine if these methods are effective. If so, the necessary specifications for implementing the use of compaction jetting and compaction flooding will be provided. The researcher will identify the pertinent WisDOT documents/manuals and provide specific language changes, but the actual revisions will be the responsibility of the Department.